

# Virtual Reality Application *Keltenwelt am Glauberg*

## New approaches in VR for archaeological sites

Marc GRELLERT, Technische Universität Darmstadt, Department Digitales Gestalten, Germany

Axel G. POSLUSCHNY, Keltenwelt am Glauberg, Germany

Ruth BEUSING, hessenARCHÄOLOGIE, Germany

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## Introduction

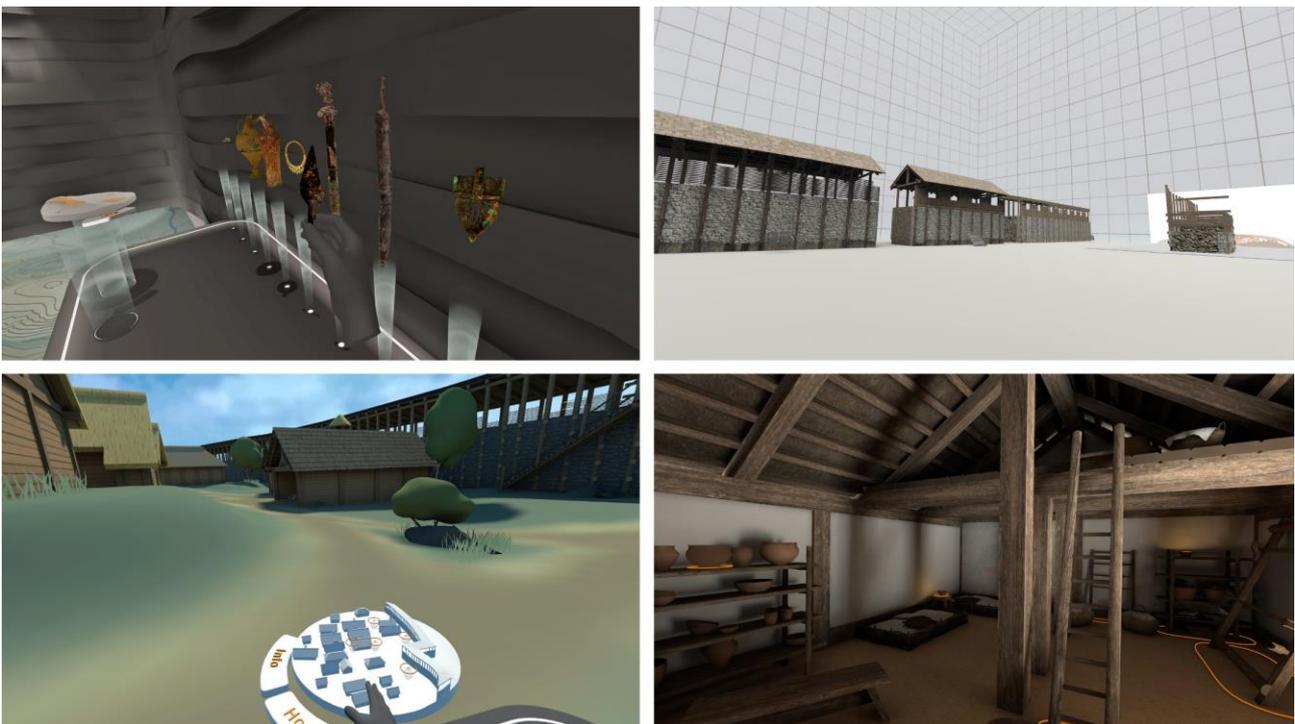
In the field of virtual reality (VR), improved displays and simple creation of VR worlds have inspired museums to make greater use of VR glasses in exhibitions and to explore boundary conditions for their use (Grellert 2018). Evoking a sense of space, of size and of embeddedness is now possible in a simple way. Dimensions of a building can be grasped as if you were standing inside it. No other interface offers this possibility. At the same time, new forms of interaction exist. For a profitable use of this feeling of presence in the context of archaeology, a careful selection of topics, spaces, buildings or settlement facilities must be made.

Using these potentials, a virtual reality application has been developed for the *Keltenwelt am Glauberg* (KWG), which uses digital forms of mediation to present the latest research to the public in an innovative way and aims to appeal to a young audience in particular. The *Glauberg* is an Early Iron Age ("Celtic") hillfort with accompanying rich burials on its slopes, surrounded by a gigantic ditch-/rampart system surrounding roughly 200 ha of its environs (Posluschny/Beusing 2019). The site – situated some 40 km northeast of the modern city of Frankfurt (Germany) – dates to the mid of the 1<sup>st</sup> millennium BC. Though the famous *Glauberg* burials present a wide range of affluent accoutrements nearly no visible remains of dwellings and settlement structures have survived. (Re-)Constructions of the hillfort and its environs need to respect these issues. The VR application of the KWG therefore deliberately does not want to follow the widespread trend towards hyper- or pseudo-realistic reconstructions of archaeological facts and instead sets its own accents and goes new ways. The aim is not to achieve unambiguity, but rather, in accordance with a fuzzy state of knowledge, to show different solutions for reconstructions and to present background information on the sources and the scientific path that led to the creation of these reconstructions. In this way, the viewers receive similar information that the archaeologists also used to approach this past world. About the general challenges of reconstructions in archaeology see Miera 2020, Schreg 2013.

## Approach

Users are first welcomed into a virtual museum thematising the bias between the well-preserved grave goods and the sparse information on the living world of the early 'Celts': 3D-scans of the burials' preserved metalwork are opposed to models of architecture and organic objects, usually less represented in archaeological record. Moreover, the Glauberg landscapes in miniature gives an overview of the local topography of the site. The VR application makes use of the interactive possibilities of the latest generation of VR glasses. Virtual objects can be held in the user's hands and viewed up close. The glasses recognise the hand movements and so it is also possible to immerse oneself in further VR worlds by virtually "pressing a button".

To meet requirements of the fuzzy knowledge, a non-realistic impression was deliberately chosen for the second level of the VR world. In a rather reduced, comic-like style, users can reach the Glauberg's plateau settlement or the burial mound. Here they can look at the surroundings and choose different viewing points. From each of the viewing points, a third immersion level can be selected, for example, the interior of a Celtic house or a large sized archaeological laboratory room on the subject of the wall surrounding the plateau around 450 BC, in which different variants of the walls and an animation of the wall construction can be seen on a scale of 1:1.



*Fig. 1. Left top: Entry room of the VR world, offering to jump to different points on the Glauberg or to examine finds; Left bottom: View from the landing point on the settlement plateau towards reconstructed houses and surrounding wall; Right top: Large sized archaeological laboratory room with variants of the wall surrounding the plateau; Right bottom: Interior of a Celtic house with areas (orange) to explore (© TU Darmstadt / KWG).*

In the VR application, paradigmatic new paths have been taken in the contexts of VR, archaeology and reconstruction. The great potential of VR in the form of immersion and conveying a feeling of presence, is not to be used to seemingly reconstruct a realistic-looking world (which in all honesty the archaeological sources would not be able to provide), but to design new experiential spaces on a 1:1 scale that can maximally serve the communication of archaeological research, methods and results, while at the same time enabling new sensory and spatial experiences.

In a first step in 2020, the archaeologists compiled the latest research results and thus laid the foundations for the reconstruction. The scenarios for VR on the Glauberg were conceived from an archaeological perspective and designed according to the current state of scientific knowledge. The archaeological findings and features on site were always at the centre of attention. On the basis of publications and previously unprocessed excavation and prospection documentation, the settlement and the sacred space around the main burial mound was evaluated and possible locations for scenarios were identified. From a list of suggestions obtained in this way, seven sites were selected in consultation with the KWG Research Centre to be elaborated as 3D models for VR.

The archaeological situation of the Iron Age on the Glauberg is difficult to interpret. The hilltop settlement was affected by a later medieval hilltop occupation. Most of the settlement remains on the slopes of the Glauberg hill have been lost through erosion and farming and only remains of very deeply dug in structures have survived. For the 3D models, a basic ground plan was created on the basis of the preserved features on site, which was supplemented by suitable parallels from other sites.

Many aspects on the Glauberg - as elsewhere - do not allow for an unambiguous reconstruction; here, possible variants were researched (e.g. for the house roofing, for the reconstruction of storage pits, etc.), which illustrate the necessary vagueness of the scientific hypotheses. The aim was not to present a staged past, but to allow the users of the applications to participate in the scientific process of discovery on the basis of the data available on site and determined by analogies from other archaeological contexts. The narrative told is not the illusion of a past as described by Eide et al. 2019 but of the researchers trying to understand and to reconstruct a past that is hard to decipher.

In order to do justice to the concept, it was also decided not to undertake a comprehensive landscape reconstruction, as no reliable statements can be made about this in detail. Only the modern terrain was thus used as a "playing field" for the individual scenarios. For this purpose, a high-resolution LiDAR scan of the terrain had to be adapted and reworked for use in VR. In parallel, digital models of the enclosure wall, the settlement on the Glauberg plateau and known Iron Age building elements and settlement types were created. In order to distinguish the state of knowledge from the hypothesis, a search was made for practicable forms of representation for those buildings and structures whose models could be found in well-preserved features of other sites and in experimental archaeologically sound test arrangements. A total of seven scenarios could be modelled. It is the aim to use the final VR application in the museum of the "Keltenwelt am Glauberg" (<https://www.keltenwelt-glauberg.de/en/>) but to also publish it for free for Oculus Quest 2 glasses to not only enable visitors to emerge in the virtual world at the Glauberg itself but to also prepare their visit at home or to enhance their onsite experience after coming back home. Using VR technologies might also help to attract and to inform new peer groups about the world of the Celts on the Glauberg and the archaeological research used to understand it. The resulting model could also be used for an AR application at the same time and is available in the respective app stores under the name "Keltenwelt AR".

## Conclusion

The use of VR can be a compelling tool for a critical approach to visualising the past, doing justice to ambiguity or fuzzy knowledge while offering users exciting spatial scenarios and experiences. However, we are only at the beginning of the development of such new digital mediation spaces.

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## Author Contributions

**Conceptualization:** Ruth Beusing, Marc Grellert, Hristo Kunchev, Axel G. Posluschny, Norwina Wölfel

**Funding acquisition:** Marc Grellert

**Investigation:** Ruth Beusing

**Methodology:** Ruth Beusing, Marc Grellert, Axel G. Posluschny

**Project Administration:** Marc Grellert

**Visualization:** Roland Ader, Patric Grlic, Hristo Kunchev, Norwina Wölfel, Arian Sadafi

**Writing – original draft:** Marc Grellert, Axel G. Posluschny

**Writing – review & editing:** Ruth Beusing, Marc Grellert, Axel G. Posluschny

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